magnet and the electric currents evolved in them carried off to the galvanometer. Now, whether the discs be of paramagnetic or diamagnetic metals, whether of iron, or bismuth, or copper, or tin, or lead, the direction of the current produced shows, that the lines of magnetic force passing through the metals is the *same* in all the cases, and hence the polarity within them the same.

The author then gives a more explicit meaning, in accordance with the definition of *line of magnetic force* contained in this paper, to some of the expressions used in the three last series of his Researches on Magnetic Condition, Atmospheric Magnetism, &c.: and by referring to former results obtained since the year 1830, illustrates how much the idea of lines of force has influenced the course of his investigations, and the results obtained at different times, and the extent to which he has been indebted to it; and then, recommending for many special reasons the mode of examining magnetic forces by the aid of a moving conductor, he brings for the present his subject to a conclusion.

December 18, 1851.

WILLIAM SPENCE, Esq., V.P., in the Chair.

The following papers were read:—

"A Proof (by means of a series) that every Number is composed of 4 Square Numbers, or less, without reference to the properties of Prime Numbers." By Sir Frederick Pollock, Lord Chief Baron, F.R.S. &c. Received December 18.

The paper contains a proof, that if every number of the form $8n+4$ is composed of 4 odd squares, then every number whatever must be composed of 4 square numbers or less; also a proof of the converse of this, viz. that if every number is composed of 4 square numbers or less, then every number of the form $8n+4$ must be composed of 4 odd squares.

It is then proposed to show that every number of the form $8n+4$ is composed of 4 odd squares, by taking a number of the form $8n+4$, viz. an odd square $+3$, and showing that $8n+4$ in that case is divisible into 4 odd squares (other than the odd square and 1, 1, 1); thus $16n^2 \pm 8n+1$ is a form that includes every odd square, and $16n^2 \pm 8n+4$ is divisible into

$$\begin{gathered}4n^2 \pm 4n+1,\\ 4n^2 \pm 4n+1,\\ 4n^2 \pm 4n+1,\\ 4n^2 \mp 4n+1.\end{gathered}$$

8 is then added, and the sum is shown to be still divisible into 4 odd squares; and again 8, and so on, until by successive additions of $8+8+8$, &c., the quantity added to $16n^2 \pm 8n$ becomes equal to the original term with which the operation commenced. The odd squares $+3$ form the series 4, 12, 28, 52, 84, &c.; and if the suc-

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cessive additions reach the third or some higher term, and also if the sum added to $16n^2+8n$ be equal to the term with which the operation commenced, it is contended the following term may be attained, and so on, and every number of the form $8n+4$ will be composed of 4 odd squares. The paper concludes by a suggestion that the method is applicable to several other similar problems.

2. "On the Valves of the Heart." By W. Savory, Esq. Communicated by Edward Stanley, Esq., F.R.S. Received September 30, 1852.

The paper contains observations upon the structure and connections of the auriculo-ventricular and arterial valves of the human heart, which the author thinks will assist in explaining their nature and functions.

The relation of the "four orifices" in the base of the heart is examined, and it is shown that the aortic and left auriculo-ventricular apertures are not separated as the others are; that no muscular tissue of the ventricle intervenes between them, but that when the auricles and great vessels are separated from the ventricles (which may be accomplished with facility after prolonged boiling), the aortic aperture is separated from the left auriculo-ventricular only by the anterior mitral valve; and when this is removed (or even while it remains), it is plainly seen that only one aperture exists whose borders are formed by the muscular tissue of the ventricle, and in shape somewhat resembling the figure 8. This is divided into two portions, an anterior (aortic) and posterior (auriculo-ventricular) by the anterior mitral valve, and above it, by the posterior wall of the aorta, into which is inserted a large portion of the anterior wall of the left auricle, but no muscular tissue of the ventricle intervenes.

When the auricles and vessels are removed, it is seen that the three orifices are bounded by thick and convex borders formed by the bases of the ventricles. Those on the left side are broadest; the difference between the two sides corresponding with the difference in thickness between the walls of the ventricles. The formation of these muscular borders, and the general arrangement and direction of the muscular fibres at these parts, is examined. The fibres forming the walls of the ventricles converge around these apertures. The most superficial fibres may be traced up from the walls of the ventricles, curving obliquely over the convex border, and having their extremities, for the most part, fixed around the orifices. We may remove these fibres layer after layer, and still find the same arrangement to obtain, the deeper fibres lying more transversely and obliquely intersecting those above and below.

If now the auricles and great vessels which have been detached are replaced in their natural situation, it is observed that the auricles are connected with the *inner* surface of these convex borders, while the walls of the vessels pass down on to the outer surface. This fact is an important one when viewed in connection with the valves, and will be presently considered. In the mean time it may be remarked, that the formation of the auriculo-ventricular grooves in which the coronary vessels lie, is explained. These vessels are